

Pursuant to the Examiner's requirement, the title of the invention has been changed so as to be clearly indicative of the invention to which the claims are directed.

A number of editorial amendments have been made to the specification and abstract. It is submitted that no new matter has been added to the application via such amendments. Enclosed is a marked-up copy of sections of the original specification and the original abstract labeled "**Marked-up Version to Show Changes Made**" indicating the same changes.

The Examiner has objected to Figures 1 and 8 as including reference numbers not mentioned in the specification. Namely, the Examiner has objected to reference numbers "5" and "6" in Figure 1 and reference number "100" in Figure 8. In order to address this objection, the specification has been amended to address these reference numbers (see page 11, line 16 for elements "5" and "6" and page 2, line 14 for element "100" of the marked-up copy of the original specification submitted herewith). It is submitted that no new matter has been added in these amendments to the specification. As a result, withdrawal of this objection is respectfully requested.

With regard to the Examiner's requirement to label Figure 8 as "Prior Art", a proposed drawing amendment to Figure 8 is submitted herewith under a separate cover letter labeling Figure 8 as "Prior Art." This drawing amendment is editorial in nature and does not add new matter to the application. In addition, new formal drawings are submitted herewith under a separate cover letter including the same amendment to Figure 8.

Claims 1-6 have been indicated as containing allowable subject matter. The Applicants would like to express their gratitude to the Examiner for this indication of allowable subject matter.

Claim 1 has been amended to address the Examiner's objection to this claim.

In addition, claims 1-6 have been amended to make a number of other minor editorial revisions. These revisions have been made to place the claims in better U.S. form. None of these amendments have been made to narrow the scope of protection of the claims, nor to address issues related to patentability and therefore, these amendments should not be construed as limiting the scope of equivalents of the claimed features offered by the Doctrine of Equivalents. Enclosed is a marked-up copy of the original claims labeled "**Marked-up Version to Show Changes Made**" indicating the same changes.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. The Examiner is invited to contact the undersigned by telephone if it is felt that there are issues remaining which must be resolved before allowance of the application.

Respectfully submitted,

Mikihiko YAMADA et al.

By: David M. Ovedovitz
David M. Ovedovitz
Registration No. 45,336
Attorney for Applicants

DMO/jmj
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
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SPECIFICATION



A Television Signal Processor That is Operable to Generate a Television Signal
From Broadcast Waves With a Plurality of Different Broadcast Standards
~~Television Signal Processor~~

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Technical Field

Technology Center 2600

The present invention relates to television signal processors, and more specifically to a television signal processor processing a received broadcast wave and generating a television signal.

Background Art

① In recent years, due to digitalization of television broadcasting, various needs or services which have been beyond imagination in general broadcasting are beginning to emerge. As to a channel which only broadcasts movie programs, for example, a technology of copy guard is important to protect a copyright so as not to allow an unlimited copy on the receiver. Recently, therefore, it was proposed to multiplex information such as copy guard into a digital broadcast wave as additional information and ^{to} carry ^{the copy guard in the wave} so as to allow the receiver to utilize the same. Such additional information is classified according to ^a standard such as CGMS (IEC1880) and WSS (ETS300, 294). As to methods how to utilize the additional information, various methods are now under consideration.

The digital broadcast wave is inputted to the receiver in

the form of a bit stream. Therefore, when the receiver is going to utilize the aforementioned additional information, the receiver first recognizes the additional information multiplexed into the digital broadcast wave, and separates the same. Thereafter the receiver generates an analog video signal from the digital broadcast wave, and then inserts the separated additional information into a retrace interval of the analog video signal to output. By performing such processing, it becomes possible to utilize the additional information in various types of peripheral equipment (for example, a video tape recorder) on the receiver. The aforementioned series of signal processing can be executed by a television signal processor illustrated below.

⑬ FIG. 8 shows a block diagram which is an exemplary conventional television signal processor¹⁰⁰. The television signal processor shown in FIG. 8 is formed by a decoding part 101, a CPU interface (hereinafter, referred to as CPUI/F) 103, a RAM interface (hereinafter, referred to as RAMI/F) 105, video data reading part 106, OSD data reading part 107, a horizontal/vertical synchronous pulse generating part 108, a video data line buffer 109, an OSD data line buffer 110, a combining part A 111, a CGMS timing generating part 112, a CGMS data buffer 113 and a combining part B 114. ✓

⑭ The decoding part 101 generates video data by processing an inputted video stream, and then outputs the same to a work RAM 102 through the RAMI/F 105. The work RAM 102 stores the video

data. Referring to FIG. 8, a CPU 104 shown ~~in~~ outside the conventional television signal processor generates OSD data. Herein, OSD (On Screen Display) stands for a channel, a receiving mode, a volume, characters of text broadcasting and the like displayed on a currently operating television screen. The OSD is generated on the basis of the OSD data generated by the CPU 104. The OSD data generated by the CPU 104 is inputted to the work RAM 102 through the CPUI/F 103 and the RAMI/F 105. The work RAM 102 stores the inputted OSD data. ✓

The video data reading part 106 reads the video data stored in the work RAM 102 at prescribed timing. The read timing at this time is defined on the basis of a read timing signal for the work RAM 102 inputted from the CPU 104 through the CPUI/F 103 and the RAMI/F 105, and a vertical pulse and a horizontal pulse generated by the horizontal/vertical synchronous pulse generating part 108. The video data read from the work RAM 102 is temporarily stored in the video data line buffer 109. The OSD data reading part 107 reads the OSD data from the work RAM 102 in a manner similar to the above. The read OSD data is temporarily stored in the OSD data line buffer 110.

The combining part A 111 combines the video data inputted from the video data line buffer 109 and the OSD data inputted from the OSD data line buffer 110. Additional information (here assumed to be CGMS) separated from the broadcast wave inputted from the CPU 104 through the CPUI/F 103 is temporarily stored in

a television signal processor which can, even if the standard of a received broadcast wave changes, flexibly cope with such change with a simpler structure and a lower cost.

Summary
Disclosure of the Invention

④
⑤ The present invention has, in order to attain the
aforementioned object, the following features/.

① A first aspect of the present invention is directed to a
television signal processor for processing a received broadcast
wave and generating a television signal, ^{The processor} which comprises:

a storage part for storing video data and additional
information separated from the received broadcast wave and OSD
data generated on a receiver;

a reading part for respectively reading the video data, the
additional information and the OSD data from the storage part;

a standard detecting part for detecting a standard of the
received broadcast wave;

a timing controlling part for respectively controlling the
timing of the reading part for reading the video data, the OSD
data and the additional information from the storage part in
correspondence to the standard detected by the standard detecting
part; and

a combining part for combining the video data, the OSD data
and the additional information read by the reading part to output
the combined data as a television signal.

As described above, in the first aspect, the standard of the received broadcast wave is detected so as to respectively control timing for reading the video data, the OSD data and the additional information from the storage part in correspondence thereto, whereby, even if the standard of the received broadcast wave changes, the video data, the OSD data and the additional information can be combined regularly at proper timing in correspondence to such change.

Conventionally, two steps of synthetic processing are included, first combining video data and OSD data in an effective display area and thereafter combining additional information in the retrace interval. In the first aspect, on the other hand, the video data, the OSD data, and the additional information are respectively read from a single storage part at prescribed timing and then combined without differentiating between the effective display area and the retrace area, whereby synthetic processing of the video data, the OSD data, and the additional information in a single combining part can be achieved.

(19) A second aspect of the present invention, which is an aspect dependent on the first aspect, is characterized in that the broadcast wave is a digital broadcast wave. ✓

(22) A third aspect of the present invention, which is an aspect dependent on the first aspect, is characterized in that the timing controlling part includes: ✓

a memory part for storing timing information for defining

the read timing of the reading part according to standard of the broadcast wave; and

(3) a reference part for referring to ^{the}~~said~~ memory ^{part}~~means~~ for timing information corresponding to the standard detected by the standard detecting part, and supply the same to the reading part,

the reading part respectively reads the video data, the additional information, and the OSD data from the storage part at timing corresponding to the timing information supplied from the reference part.

As described above, according to the third aspect, read timing for the video data, OSD data, and additional information is supplied on the basis of the standard of the broadcast wave which was previously stored. Even if the read timing is changed due to a change of the standard of the broadcast wave, each reading part can read the video data, the OSD data, and the additional information at timing corresponding to the standard detected by the standard detecting part.

(14) A fourth aspect of the present invention, which is an aspect dependent on the third aspect, is characterized in that

the memory part includes:

a first table memory stored timing information for defining read timing for video data and OSD data according to standard of the broadcast wave; and

a second table memory stored timing information for defining read timing for additional information according to

standard of broadcast wave and information in the additional information,

the reference part refers to the first table memory thereby providing the reading part with the timing information for defining the read timing for the video data and the OSD data, and refers to the second table memory thereby providing the reading part with the timing information for defining the read timing for the additional information.

As described above, according to the fourth aspect, the read timing for the additional information can be controlled in correspondence to not only a change of the standard of the broadcast wave but a change of information in the additional information.

(14) A fifth aspect of the present invention, which is an aspect dependent on the first aspect, is characterized in that

(the television signal processor further comprises a level converting part for converting an output level of the additional information read by the reading part, and

the combining part combines the additional information whose output level is converted by the level converting part into the video data and the OSD data read by the reading part.

As described above, according to the fifth aspect, the output level of the read additional information can be converted into a preferable prescribed output level.

(25) A sixth aspect of the present invention, which is an aspect

dependent on the fifth aspect, is characterized in that ✓
the level converting part converts the output level of the additional information into a level determined according to the standard detected by the standard detecting part.

As described above, according to the sixth aspect, the output level of the read additional information can be converted into a prescribed output level subjecting to the standard of the broadcast wave.

Brief Description of the Drawings

FIG. 1 shows a block diagram which is the structure of a set top box comprising a television signal processor according to an embodiment of the present invention as a video decoder.

FIG. 2 shows a block diagram which is the structure of a television signal processor according to a first embodiment of the present invention.

FIG. 3 is a flowchart showing an operation related to target value notice for reading video data Sv, OSD data So, and additional information Ss performed by an additional information recognizing part 203 of FIG. 2.

FIG. 4 shows synthetic positions of additional information with respect to a vertical synchronous pulse in the case where the video standard is 480I.

FIG. 5 shows a synthetic position of additional information with respect to a vertical synchronous pulse in the case where

the video standard is 480P.

FIG. 6 shows a synthetic position of additional information CGMS and additional information WSS with respect to a horizontal synchronous pulse.

FIG. 7 shows a block diagram which is the structure of a television signal processor according to a second embodiment of the present invention.

FIG. 8 shows a block diagram which is the structure of a conventional television signal processor.

Detailed Description of
~~Best Modes for carrying out~~ the Invention ✓

(10)
(11) FIG. 1 shows a block diagram which is an example of a set top box comprising a television signal processor according to an embodiment of the present invention. Referring to FIG. 1, an antenna 1 receives digital broadcast waves. A frequency selecting part 2 selects any broadcast wave of a specific frequency from the broadcast waves received in the antenna 1, and outputs the same to a demodulating part 3. The demodulating part 3 demodulates the broadcast wave selected by the frequency selecting part 2, and outputs the same to a transport decoder 4. ~~In~~ ^{In} the signal demodulated by the demodulating part 3, a video stream, an audio stream, additional information, and other types of information are multiplexed in a time-division manner. The signal outputted by the demodulating part 3 is called a transport stream. In the transport stream, the transport decoder 4 ✓

respectively separates the video stream, the audio stream, the additional information and other types of information which are multiplexed in a time-division manner. Thereafter the video stream is outputted to a video decoder 200 (a television signal processor 200 corresponding to a first embodiment of the present invention), the audio stream is outputted to an audio decoder 8, and the additional information Ss is outputted to a CPU 7 respectively. Copy generation control and copy guard are performed on the basis of the additional information (CGMS, WSS or the like). Further, the CPU 7 generates OSD (On Screen Display) data So, and outputs the OSD data So and the above additional information Ss to a video decoder ~~10~~ through a data bus 11. Here, OSD (On Screen Display) stands for a channel, a receiving mode, a volume, characters of text broadcasting and the like displayed on a currently operating television screen. The OSD is generated on the basis of the OSD data So generated by the CPU 7. ^{Elements 5 and 6} A work ^{represent} RAM 202 is described later along with the television signal ^{a work RAM and a main storage} processor 200. _{part, respectively.} ✓

FIG. 2 shows a block diagram which is the structure of the television signal processor according to the first embodiment of the present invention, corresponding to the video decoder 200 in FIG. 1. Referring to FIG. 2, the television signal processor 200 of this embodiment comprises a decoding part 201, an additional information recognizing part 203, a ROM 212 in the additional information recognizing part 203, a RAM interface 204, a video

state of the additional information Ss occurred with a change of the channel or the broadcasting system.

(3) An exemplary operation of the additional information recognizing part 203 is now described with reference to the block diagram ^{shown in FIG.} 2 showing the television signal processor 200 and a flowchart shown in FIG. 3. ✓

(1) FIG. 3 is a flowchart showing an operation related to target value selection performed by the additional information recognizing part 203 for reading the video data Sv, the OSD data So, and the additional information Ss ~~in order to read the video data Sv, the OSD data So and the additional information Ss from~~ ✓
~~work RAM 202 in FIG. 2, and an operation related to broadcast wave~~ ✓
~~standard notice performed with respect to the additional information synthetic position deciding part 210 when the additional information is multiplexed into the broadcast wave.~~ ✓

(1/6) First, the additional information Ss, the OSD data So, and the broadcast wave information Sb are inputted to the additional information recognizing part 203 (Step S1). The additional information recognizing part 203 stores the inputted additional information Ss and broadcast wave information Sb (Step S2). Then, the additional information recognizing part 203 outputs the additional information Ss and the OSD data So to the work RAM 202 through the RAMI/F 204 (Step S3). The additional information recognizing part 203 recognizes a standard of the broadcast wave on the basis of the broadcast wave information Sb (Step S4). The

additional information recognizing part 203 can^{also} recognize a ✓
change of the standard of the broadcast wave through the inputted
broadcast wave information Sb. In Step S5, whether or not the
broadcast wave standard ~~was~~^{has} changed is determined. If the ✓
broadcast wave standard ~~was~~^{has} changed, the operation returns to the
Step S1. If the broadcast wave standard ~~was~~^{has} not changed, the ✓
additional information recognizing part 203 stores the broadcast
wave standard of the currently selected broadcast wave (Step S6).

7P The additional information recognizing part 203 comprises the ROM ✓
212. The ROM 212 stores a plurality of target values, which are
~~notified~~^{reported} by the additional information recognizing part 203 to ✓
the reading part so that the reading part reads data from the work
RAM 202. When recognizing the standard of the broadcast wave,
the additional information recognizing part 203 refers to the ROM
212 and selects the target value corresponding to the standard
of the broadcast wave (Step S7). The selected target value is
~~notified~~^{reported} to the video data reading part 205 and the OSD data reading ✓
part 206 (Step S8). Then, whether or not the additional
information Ss was inputted is determined (Step S9). When the
additional information Ss is inputted, the additional information
recognizing part 203 notifies the additional information
synthetic position deciding part 211 of the standard of the
broadcast wave (Step S10). If the additional information Ss is
not inputted, the operation is terminated.

(25) With reference to FIG. 4, FIG. 5, and FIG. 6, the timing

of the television signal processor of this embodiment for starting ~~the combination of~~ combining the additional information at a retrace interval of video information is described. Here, two video standards for transmitting the additional information, i.e., 480I (hereinafter, referred to as video standard 480I) and 480P whose horizontal frequency is twice that of the video standard 480I (hereinafter, referred to as video standard 480P) are described. ✓

FIG. 4 shows on which positions the additional information is combined with respect to the vertical synchronous pulse when the video standard is 480I. A waveform diagram shown on the left part of the exterior of the retrace interval shows a vertical synchronous pulse. Referring to FIG. 4, two lines in total drawn on upper portions of effective display areas respectively show the synthetic positions. The positions where the lines are drawn are the 17th lines from the trailing edges of the vertical synchronous pulse respectively.

FIG. 5 shows on which position the additional information is combined with respect to the vertical synchronous pulse when the video standard is 480P. A waveform diagram shown on the left part of the exterior of the retrace interval shows the vertical synchronous pulse. A line drawn on an upper portion of an effective display area shows the synthetic position of the additional information. The position where the line is drawn is the 33rd line from the trailing edge of the vertical synchronous pulse.

1 FIG. 6 shows on which positions additional information CGMS multiplexed into the video standard 480P and additional information WSS multiplexed into the video standard 480I are combined with respect to horizontal synchronous pulses respectively. Two waveform diagrams shown in FIG. 6 each have different scales with respect to a time axis t (μs), and hence broken lines in the figure indicate which point corresponds to which for convenience in writing. Referring to FIG. 6, a synthetic position for both of the additional information CGMS and the additional information WSS is based on $t=0$, where ~~is~~ ^{is located} a trailing edge of the horizontal synchronous pulses. For the additional information CGMS, synthetic operation is started from $t = 11.2$ (μs). For the additional information WSS, synthetic operation is started from $t = 11.0$ (μs). Further, FIG. 6 shows a peak voltage ~~each~~ ^{for each of} for the additional information CGMS and the additional information WSS. These waveforms and peak voltages are set according to ^a standard. In the case of the video standard 480P and the video standard 480I, for example, a voltage of a white level at which white is displayed on a television screen is 700 mV. Further, a peak level of the additional information CGMS in the video standard 480P is 490 mV, and a peak level of the additional information WSS of the video standard 480I is set to be 500 mV.

FIG. 7 shows a block diagram which is the structure of a television signal processor according to a second embodiment of

the present invention. The television signal processor 300 shown in FIG. 7 comprises a decoding part 201, an additional information recognizing part 301, a ROM 302 in the additional information recognizing part 301, a RAM interface 204, a video data reading part 205, an OSD data reading part 206, an additional information reading part 207, a horizontal/vertical synchronous pulse generating part 208, a combining part 209 and an additional information synthetic position deciding part 210, a ROM 211 in the additional information synthetic position deciding part 210, and a level converting part 303. As to components similar to those of the first embodiment, reference numerals are rendered identical and description thereof is omitted.

The television signal processor 300 in this embodiment can convert the output level of the additional information Ss varying with a broadcast wave on which the additional information Ss is multiplexed into a standardized output level so as to combine the same. The additional information recognizing part 301 generates color conversion information on the basis of OSD data generated by the CPU 7 in FIG. 1 (hereinafter, referred to as OSD color conversion information). Hereinafter description is made under classification to an effective display area and a retrace interval.

②³ In the effective display area, OSD data So read by the OSD data reading part 206 is first inputted to the level converting part 303. The additional information recognizing part 301

outputs the OSD color conversion information generated by itself to the level converting part ³⁰³302. On the basis of the inputted OSD color conversion information, the level convertor ³⁰³302 converts the OSD data So and outputs the same to the combining part 209 in order to display the OSD data So in a given color on the screen of a television. The combining part 209 combines the color-converted OSD data So and video data Sv read by the video data reading part 205.

(a) At the retrace interval, on the other hand, the additional information recognizing part 301 can recognize the standard of a broadcast wave on the basis of the inputted broadcast wave information Sb. In the ROM 302, in addition to the target values stored in the additional information recognizing part 203 in the first embodiment, information relevant to the output level of additional information Ss previously determined according to ^a standard of the broadcast wave is stored. When the additional information recognizing part 301 recognizes the standard of the broadcast wave, therefore, the additional information recognizing part 301 refers to the ROM 302 and can select the output level corresponding to the standard of the additional information Ss. This is because the output level of the additional information Ss is determined according to ^a standard. The additional information recognizing part 301 notifies the level converting part 303 of the selected output level of the additional information Ss.

In the level converting part 303, an output level notice of the additional information Ss selected by the additional information recognizing part 301 and the additional information Ss read by the additional information reading part 207 are inputted. The level converting part 303 receives the output level of the additional information Ss notified by the additional information recognizing part 301, converts the same to the output level of the additional information CGMS or the additional information WSS shown in FIG. 6, for example, and outputs the same to the combining part 209. The combining part 209 combines the additional information Ss whose output level has been converted in the retrace interval, while combining the OSD data So and the video data Sv at an effective display interval and outputting the same as a video signal.

Industrial Applicability

The present invention can be employed for a television signal processor which can process a received broadcast wave and combine video data, OSD data and additional information regularly in a proper state.

What is Claimed is:

1. A television signal processor for processing a received broadcast wave and generating a television signal, ^{said television signal processor} comprising: ✓

storage means for storing video data and additional information separated from the received broadcast wave and OSD data generated on a receiver;

read means for respectively reading the video data, the additional information and the OSD data from said storage means;

standard detection means for detecting a standard of the received broadcast wave;

timing control means for respectively controlling ~~the~~ ✓
timing of said read means for reading the video data, the OSD data and the additional information from said storage means in correspondence to the standard detected by said standard detection means; and

combining means for combining the video data, the OSD data ^{as combined data} and the additional information read by said read means, to output ✓
the combined data as a television signal.

2. The television signal processor according to claim 1, wherein ^{the received} ~~said~~ broadcast wave is a digital broadcast wave. ✓

3. The television signal processor according to claim 1, wherein ^{comprises} said timing control means ~~includes~~: ✓

memory means for storing timing information for defining
the read timing of said read means according to ^{the} standard of ^{the received} the
broadcast wave; and ✓

reference means for referring to said memory means for
^{the} timing information corresponding to the standard detected by said ✓
standard detection means, and ^{supplying} ^{timing information} the same to said read means,
wherein

said read means respectively reads the video data, the
additional information, and the OSD data from said storage means
at timing corresponding to the timing information supplied from
said reference means.

4. The television signal processor according to claim 3, wherein
said memory means comprises:

a first table memory ^{operable to store} ~~stored~~ timing information for defining ✓
read timing for ^{the} video data and ^{the} OSD data according to ^{the} standard of ^{the received} the
broadcast wave; and ✓

a second table memory ^{operable to store} ~~stored~~ timing information for ✓
defining read timing for ^{the} additional information according to ^{the} standard of ^{the received} the
broadcast wave and information in the additional ✓
information, wherein ✓

said reference means refers to said first table memory
thereby providing said read means with the timing information for
defining the read timing for the video data and the OSD data, and
refers to said second table memory thereby providing said read

means with the timing information for defining the read timing for the additional information.

5. The television signal processor according to claim 1, further comprising level conversion means for converting an output level of the additional information read by said read means, wherein

said combining means combines the additional information, ✓
whose output level was converted by said level conversion means, ✓
^{with}
~~into~~ the video data and the OSD data read by said read means. ✓

6. The television signal processor according to claim 5, wherein said level conversion means converts the output level of the additional information ^{to} ~~into~~ a level determined according to the ✓
standard detected by said standard detection means.

ABSTRACT

In an effective display area, an additional information recognizing part 203 recognizes a standard of a broadcast wave, refers to a ROM 212 and selects a target value, and provides an internal clock of ^a video data reading part 205 and an internal clock ^{an} of OSD data reading part 206 with the target value. At a retrace interval, on the other hand, the additional information recognizing part 203 notifies an additional information synthetic position deciding part 210 of the standard of the broadcast wave. The additional information synthetic position deciding part 210 selects from a ROM 211 a target value for reading the additional information applicable to the notified standard, and outputs the ~~same~~ ^{target value} to an additional information reading part 207. When the standard of the broadcast wave is changed, ~~a~~ target value^s corresponding to the change ^{are} ~~is~~ responsively selected from the ROM 212 and the ROM 211.